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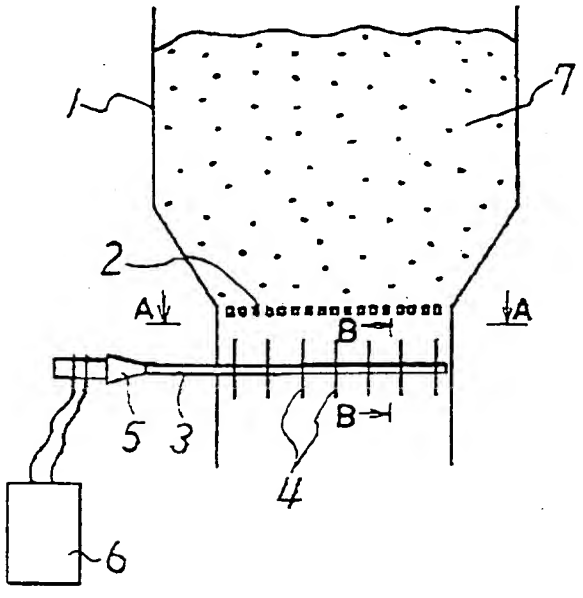
(54)【発明の名称】　粉粒体の多量供給分散装置

(57)【要約】

【目的】　多量の微細な粉粒体を連続して安定且つ均一に分散・供給する。

【構成】　粉粒体７を内部に貯蔵・供給するホッパー１の下部にスクリーン２を配設する。スクリーン２の下部から一定の間隔をあけて、振動板４を設けた振動連接棒３を配設する。振動連接棒３に超音波振動子５を取り付け、超音波振動子５に超音波発信機６を設ける。



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【特許請求の範囲】

【請求項１】　粉粒体を内部に貯蔵・供給するホッパーの下部にスクリーンを配設し、該スクリーンの下部から一定の間隔をあけて超音波振動付加手段を配設し、該超音波振動付加手段により前記ホッパー内の粉粒体を間接的に流動化させ該スクリーンの下部から流出させることを特徴とする粉粒体の多量供給分散装置。

【請求項２】　超音波振動付加手段として、複数の振動連接棒に複数の振動板を取り付け、該振動連接棒に超音波振動子を取り付け、該超音波振動子に超音波発信機を設けたことを特徴とする請求項１記載の粉粒体の多量供給分散装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は粉粒体の多量供給分散装置に関し、特に平均粒径が５０μｍ以下の粉粒体の多量且つ定量供給分散装置に関するものである。

【０００２】

【従来の技術】従来から、粉粒体を定量的かつ連続的に供給する装置としては回転テーブル式、スクリュー式、振動フィーダー式等がある。これらはいずれも比較的粒径の大きな粉粒体の多量供給に適するものであるが、平均粒径が５０μｍ以下の粉粒体の多量で定量・連続分散供給には適さない。これは粉粒体の粒径が小さくなる程粉粒体同士の凝集力が大きくなり、粉粒体の安定供給が困難となるためである。

【０００３】即ち、供給口付近にある程度以上の粉粒体が集まってその吐出圧力が粉粒体同士の凝集力に打ち勝った時にまとまった量の粉粒体が一度に吐出されるようになり、従って粉粒体供給が連続的でなく脈動する現象が生じる。この現象は、粉粒体の粒径が小さくなる程凝集力が大きくなるため顕著となり、又、粉粒体供給速度が小さくなる程供給口付近に集まる粉粒体の吐出圧力が高まるのに時間がかかるため顕著となる。

【０００４】この脈動現象を解決するための装置として実開平１－１３４６２８号公報に開示されている装置を図５に示す。本装置１１は粉粒体を供給する供給用パイプ１３と、供給用パイプ１３内を内通する振動伝達用ロッド１４を連結した振幅拡大用ホーン１６及び超音波振動子１５と、振動伝達用ロッド１４の先端に固定されているとともに供給用パイプ１３に当接し、且つ図６に示すように複数の微細孔２１を有する振動板１７から構成されている。本装置１１は超音波振動を利用して微細孔２１を有する振動板１７を振動させるため、振動板１７上の粉粒体１２を流動化させて各微細孔２１より均一に流出させることが可能となる。その結果、供給用パイプ１３内の粉粒体１２を少量且つ定量的に安定して連続供給することが容易となる。又、供給量も超音波振動子１５による振動条件等を変えることにより簡便に調整することができる。更に、供給に際して振動周波数の高い振

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動を使用するため、極めて静寂な定量供給作業を行うことができる等の点で優れている。

【０００５】

【発明が解決しようとする課題】確かに、実開平１－１３４６２８号公報記載の装置は、例えば薬品等の粉末状物を包装袋に充填、収納する場合や、微粒子の研掃材を投射して被研掃材を研掃する場合等、定量供給の対象が比較的少量な場合には効果を奏する。

【０００６】一方、ゴミ焼却炉、廃棄物焼却炉、廃棄物溶融炉、焼結炉等の排ガスの中には硫黄酸化物や塩化水素（ＨＣｌ）等の酸性有害物質が通常１００～３００ｐｐｍの割合で含まれており、これらの有害物質を除去するために最近各種のガス処理方法が開発されている。例えば、排ガス中の酸化水素等の酸性ガスを除去するためには、排ガス中に消石灰等のアルカリ成分からなる微粉粒体を連続的に多量、均一に吹き込み、中和処理により無害化をはかる。この場合、排ガス中にいかにして連続的に多量の微粉粒体を均一に吹き込むかが、酸性ガスの除去効率に大きく作用するため重要である。そして、このように微粉粒体を連続的に多量吹き込む場合には、前記装置は全く効果がない。

【０００７】実例を示すと、排ガスの量は設備の種類、規模によって異なるが、約３０００～１５００００Ｎｍ³／Ｈｒと多量であり、この排ガス中に含まれる塩化水素等の酸性ガスを除去するため連続的に吹き込むアルカリ成分からなる微粉粒体の必要量は約３０～１５００ｋｇ／Ｈｒであり、多量となる。必要とする微粉粒体の量が多量となれば、前記装置の振動板は必然的に大きくしなければならない。そうすると、振動板中央部の一箇所に振動伝達用ロッドを配設しただけでは、超音波振動子のパワーを大きくしても振動板の外方の場所では高周波振動が減衰してしまい、その結果、振動板の外方の上部にある粉粒体を流動化させることが難しくなり、微細孔から粉粒体を均一に流出させることができず、最終的には内部で粉粒体の棚吊りが発生し、全てが閉塞してしまうことになる。

【０００８】この場合、振動板に複数の振動伝達用ロッドを配設することも考えられるが、配設した複数の振動伝達用ロッドに粉粒体が付着し、この付着を起点にして粉粒体の棚吊りが発生してしまうだけでなく、振動付加設備の設備費が高価となり、保守が複雑となる。

【０００９】

【課題を解決するための手段】本発明の要旨は、粉粒体を内部に貯蔵・供給するホッパーの下部にスクリーンを配設し、該スクリーンの下部から一定の間隔をあけて超音波振動付加手段を配設し、該超音波振動付加手段により前記ホッパー内の粉粒体を間接的に流動化させ該スクリーンの下部から流出させることを特徴とする粉粒体の多量供給分散装置である。超音波振動付加手段としては、複数の振動連接棒に複数の振動板を取り付け、該振

動連接棒に超音波振動子を取り付け、該超音波振動子に超音波発信機を設けることが好ましい。

【００１０】

【作用】本発明の装置では、系外に配設した超音波振動子によりホッパー下部のスクリーンの下に配設した振動板を振動させると、振動板とスクリーンとの間にある空気が激しく振動する。これによりスクリーン上の粉粒体に全面にわたって均一な振動が付与され、粉粒体は流動化して各孔から連続して均一に流出する。流出した粉粒体がスクリーンと振動板との間を流下する間に、凝集粉は激しい空気の振動により更に分散し、均一な微細粉となる。

【００１１】

【実施例】図１に本発明の装置の一例の全体概要を示す。粉粒体７を貯蔵・供給するホッパー１の下部に多数の孔を有するスクリーン２を配設する。振動連接棒３には振動板４と超音波振動子５を取り付け、超音波振動子５には超音波発信機６を設ける。

【００１２】スクリーン２の下面と振動板４の上面との隙間の大きさはスクリーン２の開口比、供給量、付与する周波数、粉粒体の粒径等により異なるが、約５ｍｍから１５０ｍｍ位が好ましい。１５０ｍｍ以上になると空気の振動が減衰するため好ましくない。なお、スクリーン２としては、金網や、鋼板等へスリットや小孔を設けたパンチングプレートを採用することもできる。

【００１３】超音波振動子５へ伝達する高周波の適性範囲は対象とする粉粒体の粒径、付着凝集性等によって異なるが、装置の機械振動強度の面から１～４０ｋＨｚが好ましい。

【００１４】図２は図１のＡ－Ａ断面を示す。ホッパー１の形状に応じて振動連接棒３、振動板４、超音波振動子５、超音波発信機６を放射状（同図（ａ））または並列（同図（ｂ））に配設することにより、スクリーン上の粉粒体に超音波振動を均一に伝達できる。

【００１５】図３は図１のＢ－Ｂ断面を示す。振動板４の形状は、図示のように各種採用できる。

【００１６】図４に本発明の装置を利用する例を示す。これは本発明の装置を廃棄物の焼却炉８、ボイラ９とダストの集塵機１０との間に設置した例である。廃棄物の焼却により発生した排気ガスには、本発明の装置において消石灰等のアルカリ成分からなる微粉粒体を連続的に多量、均一に吹き込んで中和処理により無害化し、煙突２２から大気中に放散することができる。

【００１７】

【発明の効果】本発明の粉粒体の多量供給分散装置は、振動連続棒に振動板を多数枚連結することで、設備の機能を確保したまま大型化が可能となり、そのため多量の粉粒体であっても連続的に安定して均一に供給分散できる。また、スクリーンの面積を大きくできるため粉粒体の堆積圧力を小さくでき、棚吊りを生じやすい超微粉においても棚吊りが発生しなくなり、さらに、スクリーンの面積を大きくすると異物や粗粒が混入していても安定定量供給を阻害されない。そして、本発明の粉粒体の多量供給分散装置は分散効果が大きいため分散後の粉粒体の比表面積が大きくなり、粉粒体と搬送ガス、処理対象ガスとの接触効率が良くなり、反応効率が上昇する。

【図面の簡単な説明】

【図１】本発明装置の一例を示す図である。

【図２】図１のＡ－Ａ断面を示す図である。

【図３】図１のＢ－Ｂ断面を示す図である。

【図４】本発明装置を利用する例を示す図である。

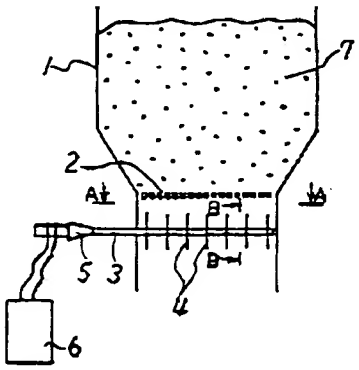
【図５】従来の装置を示す図である。

【図６】従来の装置の振動板を示す図である。

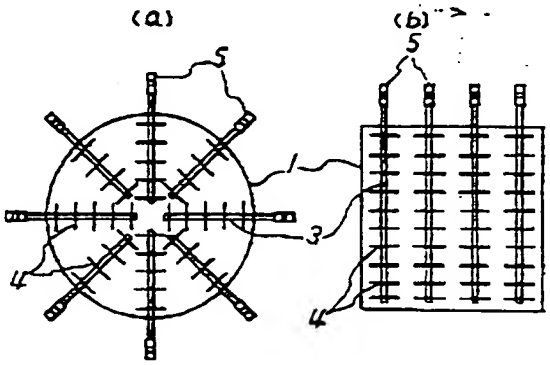
【符号の説明】

１　ホッパー
２　スクリーン
３　振動連接棒
４　振動板
５　超音波振動子
６　超音波発信機
７　粉粒体
８　焼却炉
９　ボイラ
１０　集塵機
１１　粉粒体の定量供給装置
１２　粉粒体
１３　供給用パイプ
１４　振動伝達用ロッド
１５　超音波振動子
１６　振幅拡大用ホーン
１７　振動板
１８　微細孔
２１　微細孔
２２　煙突
２３　ブロワー

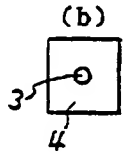
【図1】



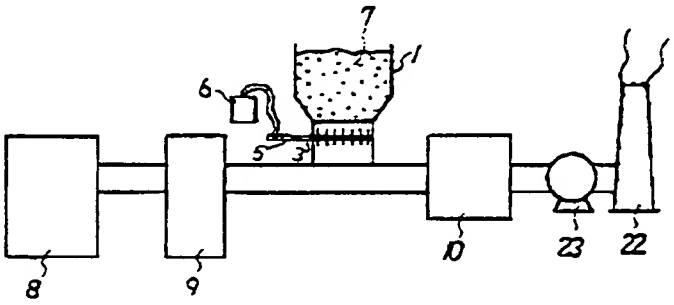
【図2】



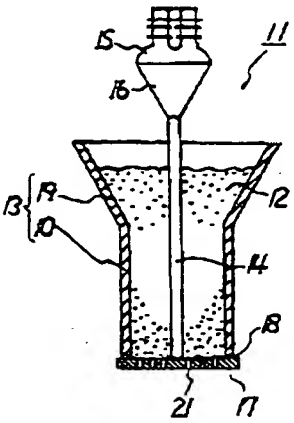
【図3】



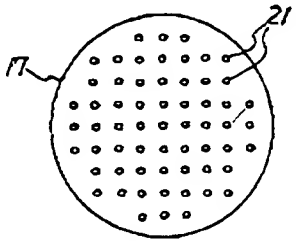
【図4】



【図5】



【図6】



Maki

TRANSLATION FROM JAPANESE

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G 01 F 13/00	341	Y	
			B 01 D 53/34 118 Z

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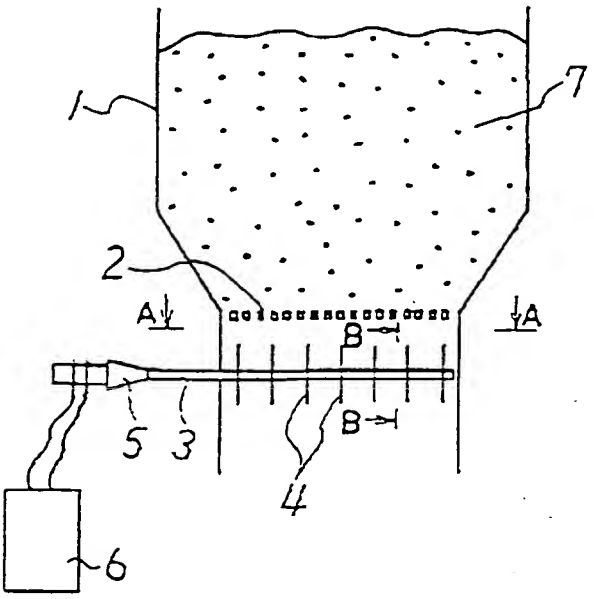
(71) Applicant: 000008655 (Nippon Steel Corporation)
(72) Inventor: Mutsuo Maki
(74) Agent: Masamitsu Akizawa, Patent Attorney (and one other)

(54) [Title of the Invention] **Apparatus for Feeding and Dispersing Large Amount of Particulate Material**

(57) [Summary]

[Object] To continuously disperse/feed a large amount of a fine particulate material in a stable and uniform fashion.

[Structure] A screen 2 is provided to the bottom of a hopper 1 for storing and feeding a particulate material 7. Vibrating continuous rods 3 provided with vibrating plates 4 are placed at a given distance from the bottom of the screen 2. Ultrasonic vibrators 5, which are attached to the vibrating continuous rods 3, are equipped with ultrasonic transmitters 6.



[Claims]

[Claim 1] An apparatus for feeding and dispersing a large amount of a particulate material, characterized in that a screen is provided to the bottom of a hopper for storing and feeding a particulate material, means for imparting ultrasonic vibrations are placed at a given distance from the bottom of said screen, and the particulate material in said hopper is indirectly fluidized and discharged downward through said screen by said means for imparting ultrasonic vibrations.

[Claim 2] An apparatus for feeding and dispersing a large amount of a particulate material as defined in Claim 1, characterized in that a plurality of vibrating plates are attached to a plurality of vibrating continuous rods as the means for imparting ultrasonic vibrations, ultrasonic vibrators are attached to said vibrating continuous rods, and ultrasonic transmitters are provided to said ultrasonic vibrators.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Utilization] The present invention relates to an apparatus for feeding and dispersing a large amount of a particulate material, and more particularly to an apparatus that allows a particulate material with a mean grain diameter of 50 μm or less to be fed and dispersed in a large amount at a constant rate.

[0002]

[Prior Art] Rotary tables, screws, vibratory feeders, and the like are used as the equipment for continuously feeding particulate materials at constant rates. Such equipment, while suitable for feeding a large amount of a particulate material of comparatively large grain size, cannot be used for continuously dispersing/feeding a large amount of a particulate material whose mean grain diameters is 50 μm or less at a constant rate. This is because cohesion among particles becomes more pronounced and stable supply of the particles is impaired as the grains of the particulate material decrease in diameter.

[0003] Specifically, a particulate material is expelled as a single mass of particles when a certain minimum amount of such particles has accumulated near the feed port, and the discharge pressure thereof exceeds the cohesion among the particles, resulting in a pulsating, rather than continuous, supply of the particulate material. Cohesion increases and the above-described phenomenon becomes more pronounced as the grain diameter of the particulate material decreases. In addition, the phenomenon becomes more pronounced with a reduction in the rate at which the particulate material is fed because such a reduction requires a longer time for increasing the discharge pressure of the particulate material accumulated near the feed port.

[0004] The apparatus described in Japanese Laid-Open Patent Application 1-134628 as one aimed at preventing such pulsations is shown in Figure 5. The main apparatus 11 comprises a feeding pipe 13 for supplying a particulate material, a vibration-enhancing horn 16 and an ultrasonic vibrator 15 connected to a vibration-transmitting rod 14 passing through the feeding pipe 13, and a vibrating plate 17 fixed to the tip of the vibration-transmitting rod 14, pressed against the feeding pipe 13, and provided with a plurality of fine holes 21, as shown in Figure 6. Because the vibrating plate 17 having the fine holes 21 is vibrated by making use of ultrasonic vibrations, the main apparatus 11 can fluidize the particulate material 12 on the vibrating plate 17 and to discharge it uniformly through the fine holes 21. As a result, it is easy to stably feed small amounts of the particulate material 12 in the feeding pipe 13 at a constant rate. The feed rate can be easily adjusted by varying the vibration conditions and other attributes of the ultrasonic vibrator 15. Another advantage of this apparatus is that the material can be fed at a constant rate very quietly because high-frequency vibrations are used during feeding.

[0005]

[Problems Which the Invention Is Intended to Solve] The apparatus described in Japanese Laid-Open Patent Application 1-134628 is indeed effective when, for example, a pack is filled with a drug or other powdery material, when a workpiece is polished and cleaned by being blasted with an abrasive material, or in any other case in which the material being supplied at a constant rate is fed in a relatively small amount.

[0006] Meanwhile, exhaust gases from garbage incinerators, waste incinerators, waste melting furnaces, sintering machines, and the like usually contain sulphur oxides, hydrogen chloride (HCl), and other hazardous acid substances in ratios of 100–300 ppm, and various gas treatment methods have recently been developed in order to remove these hazardous substances. To remove hydrogen oxide and other acid gases from the exhaust gases, for example, large amounts of microparticulate materials consisting of slaked lime and other alkali components are continuously and uniformly blown into the exhaust gases in order to render the substances harmless by performing a neutralizing treatment. In this case, the manner in which large amounts of microparticulate materials are blown continuously and uniformly into the exhaust gases is important for increasing the efficiency with which the acid gases are eliminated. Thus, the equipment described above is totally ineffective for continuously blowing large amounts of microparticulate materials.

[0007] To consider an actual example, the flow rate of an exhaust gas, while varying with the type and scope of the equipment, is considerable (about 30,000–1,500,000 Nm^3/hr), and the required amount of a microparticulate material consisting of alkali components being continuously blown in order to remove hydrogen chloride and other acid gases from this exhaust gas is also considerable (about 30–1500 kg/hr). The requirement to supply a large number of a microparticulate material inevitably leads to the use of a larger vibrating plate in the above-described apparatus. Merely installing a vibration-transmitting rod at a single position in the center of the vibrating plate will lead to a reduction in the high-frequency vibrations in areas outside the vibrating plate even when the power of the ultrasonic vibrator is increased, making it difficult for the particulate material in the upper portions outside the vibrating plate to be fluidized, preventing this particulate material from flowing uniformly through the fine holes, and, ultimately, causing the particulate material inside the apparatus to form bridges and to clog the entire apparatus.

[0008] Providing the vibrating plate with a plurality of vibration-transmitting rods has been proposed for such cases, but particulate materials adhere to such vibration-transmitting rods, not only causing bridging around the points of adhesion but also increasing the capital cost of vibration-imparting equipment and making its maintenance more complicated.

[0009]

[Means Used to Solve the Above-Mentioned Problems] The main point of the present invention is an apparatus for feeding and dispersing a large amount of a particulate material characterized in that a screen is provided to the bottom of a hopper for storing and feeding a particulate material, means for imparting ultrasonic vibrations are placed at a given distance from the bottom of the screen, and the particulate material in the hopper is indirectly fluidized and discharged downward through the screen by the means for imparting ultrasonic vibrations. It is preferable to use an arrangement in which a plurality of vibrating plates are attached to a plurality of vibrating continuous rods as the means for imparting ultrasonic vibrations, ultrasonic vibrators are attached to the vibrating continuous rods, and ultrasonic transmitters are provided to the ultrasonic vibrators.

[0010]

[Effect of the Invention] In the apparatus of the present invention, the air between the vibrating plates and the screen vibrates vigorously when the vibrating plates underneath the screen at the bottom of the hopper are vibrated by the external ultrasonic vibrators. Uniform vibrations uniformly spread across the entire surface are thereby transmitted to the particulate material on the screen, fluidizing this particulate material and allowing it to flow continuously and uniformly through the holes. As the particulate material outflow descends through the space between the screen and the vibrating plates, aggregated particles are further dispersed by the vigorous vibration of the air, producing a uniform fine powder.

[0011]

[Practical Examples] Figure 1 is a schematic overview of an example of the apparatus of the present invention. A screen 2 having multiple holes is provided underneath a hopper 1 for storing and feeding a particulate material 7. Vibrating plates 4 and ultrasonic vibrators 5, which are attached to the vibrating continuous rods 3, are equipped with ultrasonic transmitters 6.

[0012] The size of the gap between the lower surface of the screen 2 and the upper surfaces of the vibrating plates 4, while varying with the relative aperture of the screen 2, the feed rate, the frequency imparted, the grain diameter of the particulate material, and the like, is preferably about 5–150 mm. A grain diameter above 150 mm is unsuitable because of the decreased vibration of the air. A wire mesh or a punching plate obtained by slitting or perforating a steel plate or the like may be used as the screen 2.

[0013] The range of high frequencies suitable for transmission to the ultrasonic vibrators 5, while varying with the grain diameter of the particulate material involved, the adhesion and aggregation properties, and the like, is limited to 1–40 kHz by the mechanical vibration strength of the apparatus.

[0014] Figure 2 is cross section A-A in Figure 1. Ultrasonic vibrations can be uniformly transmitted to the particulate material on the screen by arranging the vibrating continuous rods 3, vibrating plates 4, ultrasonic vibrators 5, and ultrasonic transmitters 6 radially (Figure 2a) or in a row (Figure 2b), depending on the shape of the hopper 1.

[0015] Figure 3 is cross section B-B in Figure 1. As shown in the drawing, the vibrating plates 4 may have various shapes.

[0016] Figure 4 depicts an example in which the apparatus of the present invention is adopted. In this example, the apparatus of the present invention is placed between a dust catcher 10 and a waste incinerator 8 and boiler 9. In the case of an exhaust gas produced by the incineration of waste, a fine particulate material composed of slaked lime and other alkali components can be continuously and uniformly introduced at a high rate into the apparatus of the present invention, rendered harmless by a neutralizing treatment, and released into the atmosphere through a stack 22.

[0017]
[Merits of the Invention] The proposed apparatus for feeding and dispersing a large amount of a particulate material can be enlarged while its functions are preserved by linking a plurality of vibrating plates to the vibrating continuous rods, allowing even large amounts of particulate materials to be continuously fed and dispersed in stable and uniform fashion. In addition, enlarging the surface area of the screen makes it possible to reduce the pressure from the accumulated particulate material, to prevent superfine

powders prone to bridging from forming bridges, and to ensure an unimpeded supply of the material at a constant rate even when the material contains foreign matter or coarse grains. Furthermore, the enhanced dispersion effect of the proposed apparatus for feeding and dispersing a large amount of a particulate material increases the specific surface of the dispersed particulate material, enhances the efficiency of contact between the particulate material and the carrier gas and the treated gas, and makes the reactions more efficient.

[Brief Description of the Figures]

[Figure 1] A diagram depicting an example of the apparatus of the present invention.

[Figure 2] A diagram depicting cross section A-A in Figure 1.

[Figure 3] A diagram depicting cross section B-B in Figure 1.

[Figure 4] A diagram depicting an example in which the apparatus of the present invention is used.

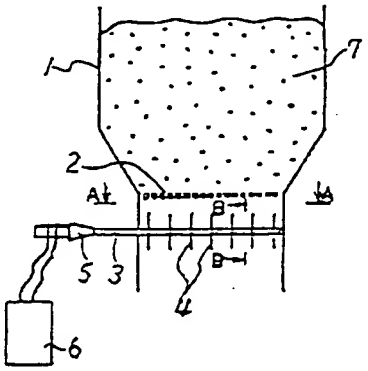
[Figure 5] A diagram depicting a conventional apparatus.

[Figure 6] A diagram depicting a vibrating plate of the conventional apparatus.

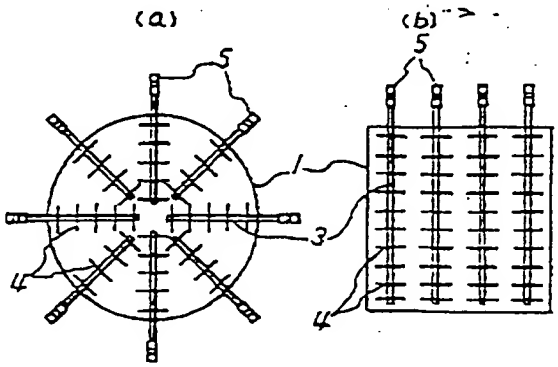
[Key]

1: hopper, 2: screen, 3: vibrating continuous rod, 4: vibrating plate, 5: ultrasonic vibrator, 6: ultrasonic transmitter, 7: particulate material, 8: incinerator, 9: boiler, 10: dust catcher, 11: apparatus for feeding particulate material at constant rate, 12: particulate material, 13: feeding pipe, 14: vibration-transmitting rod, 15: ultrasonic vibrator, 16: vibration-enhancing horn, 17: vibrating plate, 18: fine hole, 21: fine hole, 22: stack, 23: blower

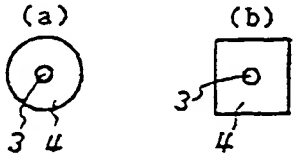
[Figure 1]



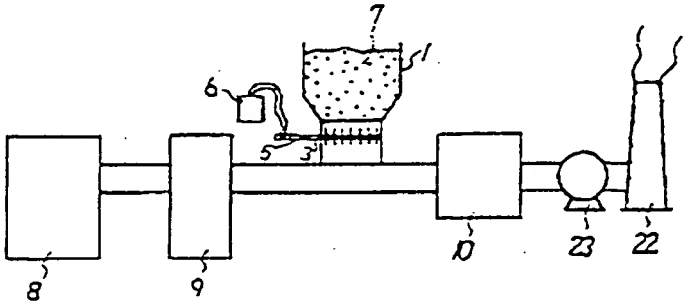
[Figure 2]



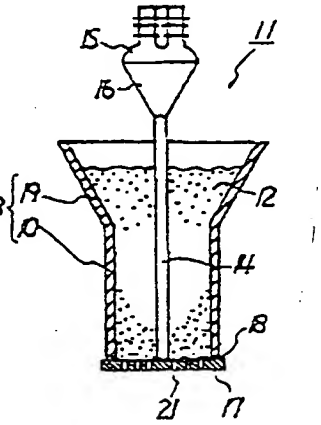
[Figure 3]



[Figure 4]



[Figure 5]



[Figure 6]